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ABSTRACT

The purpose of this study was to determine the types of research methods used to study cognitive processing development in gifted learners, from 1975-1986. Of 870 research publications identified on giftedness, 522 publications (60 percent) dealt with cognitive processing development. Research designs used most frequently were causal-comparative, correlational, and case studies. Mean sample size across all designs was 141.65, and the mean number of variables studied per design was 2.7. Fifty-two percent of the studies used elementary-aged gifted children. Concerns are raised that more innovative research designs are needed to study metacognition, a more balanced age spread among samples is needed, and research questions need to be more Focused. (JDD)

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Research Methodology in the Cognitive Development of Gifted Learners: A Preliminary Analysis

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Abstract

The purpose of this study was to determine the types of research methods used to study cognitive processing development in gifted learners over the last decade (1975-1986). A total of 522 research publications were found for this period. Results indicated that this topic comprised 60% of the research studies conducted on giftedness during this period. The research designs used most frequently were causal-comparative (36%), correlational (31%), and case study (11%). Mean sample size across all designs was 141.65, and the mean number of variables studied per design was 2.7. Fifty-two percent of all research studies on cognition during this period used elementary-aged gifted children. The PSYC database proved to be the most useful search source for research on cognition, although 41% of its citations were unpublished research ian the form of dissertation reports. Concerns were raised that more innovative research designs are needed to study metacognition, a more balanced age spread among samples studied is needed, and research questions need to be more focused. It is believed the analysis undertaken in this study may contribute to a reassessment of the value of research in general across the entire field of gifted education.

Research Methodology in the Cognitive Development of Gifted Learners: A Preliminary Analysis

Introduction

In the past decade there has been increasing interest in human intellectual processing, as evidenced by the number of newly established journals devoted to this perspective and by the large number of articles on this subject in more traditional publications. Moreover, attention to the intellectual processing of more able learners has been a preferred strategy for gathering information on this topic for some researchers (for example, Sternberg, 1981). This study sought to answer what are the research methods currently being used to study cognitive processing/development in gifted learners. After this preliminary analysis, it is planned to consider the general quality of these research studies.

Theoretical Framework

In recent years, the study of human intellectual development has been dubbed,"Cognitive Science" (Gardner, 1985), although the roots of this new science can be found as far back as Plato's Meno. Rene Descartes represented a seventeenth century forerunner of cognitive science with his clear distinctions between rational mind and physical body. Philosopy, as the antecedent to cognitive science, was based primarily on one method of "research," namely, the thorough examination of one's own mental contents and methods for processing. This method is parallelled

today as the research methodology of "protocol analysis", in which a subject talks aloud while in the act of solving a problem or producing something creative. Generally, it could be argued that such a method is subject to a multitude of internal and external threats to validity, although recent articles have suggested this as a highly viable method for tracing the intellectual processing of the gifted (Perkins, 1981; Jenkins-Friedman, 1986; Anderson, 1986; Shore, 1986).

Psychologists have attempted to discover the basic laws of cognitive development for at least the last century, utilizing a variety of ingenious research methods for gathering data. The behaviorists, by limiting what might be defined as intellectual processing to what may be observed as overt behavior, utilized several experimental and quasi-experimental research designs. Recent criticism of behaviorist methodology has focused on the limitations the behavioral operationalization of cognitive processing may have placed on full understanding of the human mind (Gardner, 1985). Information-processing theory has brought with it new methods for understanding mental development, namely attempts to duplicate problem solving behaviors through the creation of a computer model. The computational model, however, has proven paradoxical in that only by scrupulous adherence to replication of human thought in computer terms could scientists discover the ways in whch human thinking differs from a serial digit computer. Thus, the construct validity of information processing methodology may be much in question. In general, the trends in psychology over the past 100 years have been twofold: (1) an increased disunity among concepts and perspectives on

human processing; and, (2) a drive toward methodological perfection in understanding intellectual process, as witnessed by the invention of new instruments, more sophisticated statistical techniques, and the design of increasingly more elegant individual studies (Clark, 1988). As Gardner (1985) questioned, however, there is some concern about whether or not our more convincing experimental demonstrations have led directly to more penetrating knowledge about human cognition or merely reconfirmed previously established knowledge.

The transition from the general field of cognitive science to the field of gifted studies has been gradual but consistent. Sternberg's controversial "triarchic theory of intelligence" has been posited on his examination of the problem solving strategy selection behaviors of gifted learners (Sternberg, 1981; 1982; 1986a; 1986b). His own research methodology appears to have been centered around causal-comparative and case study designs, in which processing differences among gifted and normal learners have been assessed by time required and success of solution to a series of logical analogies. Jensen (1981; 1985) and Eysenck (1985) have also explored such designs in measuring the physical reaction times of gifted learners to the recognition of visual and verbal similarities and differences. Much of this research has led to controversy on the measurement of intelligence. Silverman (1986) edited a recent issue of Roeper Review on "The IQ Controversy". Although she hoped to put the controversy to rest, an opposite effect may have taken place. The reader of that issue may be just as much in the dark on how much faith to

put in the IQ test as he/she was before the reading. The test controversy is far from settled, as witnessed by annual criticisms of one test battery or another (for example, Clarizio & Mehrens, 1985, versus Roid, 1985). While Rogers (1986) reviewed over 100 articles devoted to differences in the cognitive development, cognitive strategy selection behaviors, and cognitive styles of gifted learners, she reported a woeful lack of strong research methodology among researchers on these questions. Jenkins-Friedman (1986) noted the need for new ways of assessing gifted processing, as guest editor of the Gifted Child Quarterly "Special Focus on Research" issue. A rationale was provided in that issue to explore the use of longitudinal, single-subject, protocol analysis and meta-analysis research methods to examine a variety of learning phenomena in the gifted.

Method

In an effort to collect all articles written in the area of cognitive development over the past decade, four database searches were undertaken to cover the years, January, 1975, to December, 1986. A total of 522 separate research-based citations were produced from the searches of Educational Resources Information Center (ERIC), Exceptional Children Education Resources (ECER), Psychological Abstracts Information (PsychINFO), and Child Development Abstracts. Topical descriptors included within the category of cognitive development were (1) cognitive characteristics (n=225 publications); (2) psychological development (n=98 publications); (3) creativity (n=33 publications); and, (4) identification/labeling (n=166

publications). This generalized approach to cognition and cognitive development was chosen to take into account the current multiplicity of implicit and explicit conceptions of giftedness and of intellectual processing.

These studies were then coded by year of publication, type of publication, database source, type of research design, sample size, study sample age, and number of research variables studied. Type of publication was classified into six sources: (1) journal; (2) government report; (3) conference paper; (4) state or school district report; (5) college/commercial press publication; and (6) doctoral dissertation. In the few cases in which a conference paper was later developed into a journal article, the first publication of the study (usually the conference paper) was used for coding. In coding for database, ERIC was used for any article found in more than one database; consequently, any publications coded as ECER or PsychINFO were only found in those databases. No separate codings were noted for Child Development Abstracts. Categories of research design were defined by Borg & Gall's (1983) designations. These classifications included: (1) quasi-experimental; (2) review of research (meta-analysis); (3) protocol analysis (content, discourse analysis); (4) survey; (5) case study; (6) correlation/regression/discriminant analysis; (7) causal-comparative; and (8) factor analysis. Since many research studies represent more than one type of design, classification was by the design that most clearly matched the initial description of the purpose of the study. If this was not immediately evident in the study description, then the design was

coded by the first procedure described in the "Method" section of the paper. Study sample ages were categorized into six mutually exclusive levels: (1)preschool/primary; (2) elementary; (3) secondary; (4) K-12; (5) college/adult; and (6) all ages. A random selection of 10% of the research studies were recoded by the researcher to verify coding accuracy. A 95% reliability rate was maintained.

Analysis and Results

Descriptive statistics were computed for the frequencies and percentages of research on cognitive development for each research design, year of publication, database source, sample size, sample age, and number of variables included for study. The research designs used most frequently for studies of cognitive processing among the gifted were: (1) causal-comparative (36%); (2) correlation/regression (31%); and (3) case study (11%). Over the ten-year period, articles dealing with cognition accounted for 522 of the total 870 research studies published during that time, or approximately 60% of the research undertaken. Table One summarizes the frequencies and percentages of each type of research design used year by year during the 1975-1986 period. A Chi-Square analysis of design frequencies indicated significantly more causal-comparative and correlational studies than expected and significantly fewer quasi-experimental and protocol analysis studies than expected (= 48.24, df = 24, $p<.05$). The number of research articles per year on cognitive issues ranged from 13 to 66 over the decade, with a general trend toward increased study on this topic in the latter half of the

time period. A trend analysis of the year by year frequencies indicated a significantly greater than expected frequency in 1978 (n=47); and significantly fewer than expected according to the trend for 1985 (n=48) at the $p<.05$ level.

Insert Table One About Here.

Sample sizes for research studies on cognitive development over the 1975-1986 period ranged from 3 to 5,649 ($\bar{x}$ = 141.65). The number of variables studied per research study over the 1975-1986 decade ranged from 1 to 36 ($\bar{x}$ = 2.7). Table Two shows the ranges in sample size and number of variables studied for each research design category. Sample size was not reported for 12% of the studies, nor was the number of variables for 3% of the published articles. In general, the number of variables studied did not vary greatly from one research design type to another, but the size of sample did. Quasi-experimental studies tended to include fewer subjects ($\bar{x}$ = 39.6), while factor analysis studies included the greatest number of subjects ($\bar{x}$ = 227.3). Protocol analysis studies ($\bar{x}$ = 52.3) and case studies ($\bar{x}$ = 66.5) tended to use greater numbers of subjects than had originally been anticipated.

Insert Table Two About Here.

Age levels studied by each cognitive development research were also counted by frequency and percentage on a year to year

basis. A Chi-Square analysis of age level frequencies revealed that there were significantly more studies of elementary gifted children than expected (= 66, df = 42, p<.05), with these studies comprising 52% of all studies done during this period. Table Three summarizes the frequencies of age levels studied year by year during the 1975-1986 time period.

Insert Table Three About Here.

In looking at the data in more general terms, there were significant differences in the types of publications and data-bases in which the 522 reports of research were found. Tables Four and Five summarize these data, respectively. A Chi-Square analysis (= 29.41, df = 15, p<.05) of the frequency of cognitive development research reported in a particular category of publication indicated that the significant majority of the studies were either journals (53%, n = 276) or doctoral dissertations (41%, n = 216). There was a pronounced increase in the publication of journal studies and dissertation reports during the latter half of the decade. Moreover, there was a distinct pattern to the types of publications which were more likely to be found in a specific database: PsychINFO contained a significantly larger number of journal articles than did ERIC or ECER and was the only database reporting dissertation research. The greatest variety of publications was found in ERIC, although a larger number of research-based journal articles and college/commercial publications were found in the ECER database.

Insert Tables Four and Five About Here.

Typical Examples of the Research

In this section of the paper, illustrative examples will be given for the types of studies, age levels, sample sizes, and numbers of variables found across the entire research base for the 1975-1986 time period.

Quasi-experimental Study: Scruggs, T.E., Mastropieri, M.A., Jorgensen, C. & Monson, J. (1986). Effective mnemonic strategies for gifted learners. Journal for the Education of the Gifted, 9 (2), 105-121.

Sample Size: 96

Age Level: Elementary

Number of Variables: 2 independent variables X ability X 2 test performance variables (n=5)

Outcome: Gifted outperformed nongifted when provided mnemonic instruction, although both groups benefited from such instruction. Only the gifted group was able to transfer strategy to another content area.

Review of Research/Meta-analysis: Shore, B.M. (1986). Cognition and giftedness: New research directions. Gifted Child Quarterly, 30 (1), 24-27.

Sample size: 23 (studies)

Age level: All ages

Number of variables: Not applicable

Outcome: A review of potential research methods in studying metacognition with examples of well-designed studies which avoid problems of ecological validity.

Protocol Analysis: Kitano, M.K. (1985). Ethnography of a preschool for the gifted: What gifted young children actually do. Gifted Child Quarterly, 29 (2), 67-71.

Sample size: 20

Age level: Preschool

Number of variables: 3

Outcome: Sixty hours of observational data (analysis of field notes) indicated advanced levels of accumulated knowledge, prelogical thinking, avoidance of ambiguity, competitiveness, lack of group cohesiveness, and social maturity across group.

Survey: Benbow, C.P. & Stanley, J.C. (1980). Intellectually talented students: Family profiles. Gifted Child Quarterly, 24 (3), 119-122.

Sample size: 873

Age level: Secondary

Number of variables: 3

Outcome: Families of mathematically gifted adolescents found to be relatively large, father's educational level and occupational level high, especially for the male participants in the 1976 Talent Search at Johns Hopkins.

Case Study: Olson, M.B. (1984). What do you mean by spatial? Roeper Review, 6 (4), 240-244.

Sample size: 62

Age level: Elementary

Number of variables: 2 (styles) X 12 (processing performances) (n=14)

Outcome: In this study of middle school gifted students, two styles of students were identified on the basis of task and test performance. Each "style" tended to score highly on different arrays of cognitive and spatial tasks and tests.

Correlation/Regression/ Discriminant Analysis: Pyryt, M.C. (1986). Using discriminant analysis to identify gifted children. Journal for the Education of the Gifted, 9 (3), 233-238.

Sample size: 46

Age level: Elementary

Number of variables: 3

Outcome: Results of 3 variables (conception of physical appearance and attributes, intellectual ability, and concept of personal happiness and satisfaction) indicated that an optimal prediction equation can correctly classify approximately 75% of children.

Causal-Comparative: Hermelin, B. & O'Connor, N. (1980). Perceptual, motor, and decision speeds in specifically and generally gifted children. Gifted Child Quarterly, 24 (4), 180-185.

Sample size: 42

Age level: Elementary

Number of variables: 2 ability X 3 performances (n=5)

Outcome: Musically gifted children were significantly faster than high IQ or control groups in identifying verbal similarities, speed of motor response in verbal and visual matching. Musically gifted and high IQ significantly faster in perceiving visual identifiers (matching words and pictures).

Factor Analysis: Scholwinski, E. & Reynolds, C.R. (1985). Dimensions of anxiety among high iq children. Gifted Child Quarterly, 29 (3), 125-130.

Sample size: 584

Age level: K-12 (ages 7-18)

Number of variables: 37 (items)

Outcome: Five significantly intercorrelated factors emerged from the 37 items on the Children's Manifest Anxiety Scale: Physiological, Worry/Oversensitivity, Concentration, Lie 1 ("always statements"), and Lie 2 ("never" statements).

Discussion and Implications

Only by becoming aware of the research topics surrounding cognitive development among gifted learners already adequately addressed by researchers, can we hope to go forward with appropriate research questions in the future. Of great concern as this research analysis was conducted was the small percentage of total publications on gifted studies which were research-based: only 20% of the total publications for the 1975-1986 period were reports of actual research. Furthermore, although the majority of these articles were listed in ERIC, only 9% of the ERIC listings were research-based. PsychINFO held the "lion's share" of

research in the gifted field (83%, n=433).

This preliminary analysis has been concerned primarily with the kinds of research that have been carried out in the past decade. Further analysis will evaluate the quality of these studies. At first glance on this future study, however, it seems apparent that researchers in the gifted field have not kept current in their selections of designs to answer questions or test hypotheses dealing with cognitive science. There is a continued reliance on the more traditional designs even when operationalizing some of the newer variables of cognitive science, such as "nonentrenchment," "front end analysis," "transfer," and "retrieval cue selection." Perhaps this may be part of Gardner's (1985) concern, that we are reconfirming what we have previously suspected rather than making new discoveries about human intelligence and giftedness.

In this preliminary analysis alone, it is painfully evident that no real understanding of gifted cognitive development has been obtained and probably will not be until more focus is placed on cognition among preschoolers, adolescents and adults. Likewise, it is becoming increasingly necessary to focus research on a few topics and explore answers in depth, rather than pursue questions across such diverse areas as psychological development, cognitive characteristics, creativity and identification. Furthermore, only by facing the limitations of present research methodology and the potential overuse of some research designs in the gifted field, where questions of cognitive processing are concerned, can we hope to go forward with well-designed future research. It is believed that the analysis undertaken in this

study may contribute to a reassessment of the value of research in general across the entire field of gifted education.

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Table 1

FREQUENCIES AND PERCENTAGES OF COGNITIVE RESEARCH PUBLICATIONS
BY DESIGN TYPE AND YEAR OF PUBLICATION

Year of Publication	Case Study	CC	QE	PA	RRMA	S	CR	FA	Total	Total %
1975	1	2	0	0	1	2	7	0	13	2.4
1976	2	10	0	0	3	3	8	3	29	5.5
1977	1	11	1	0	0	1	9	0	23	4.4
1978	5	18	2	1	0	0	19	2	47*	9.0*
1979	3	6	0	1	3	4	8	0	25	4.8
1980	7	16	0	0	3	3	10	0	39	7.4
1981	3	19	0	0	6	5	12	2	47	9.0
1982	7	25	1	0	4	5	16	5	63	12.0
1983	10	23	0	0	8	8	13	4	66	12.6
1984	9	26	0	1	5	2	20	2	65	12.4
1985	7	17	0	0	2	2	18	2	48*	9.2
1986	4	17	1	1	4	4	23	3	57	10.9
Total	59 (11%)	190 (36%)*	5* (1%)	4* (.9%)	39 (8%)	39 (8%)	163* (31%)	23 (4%)	522	100

*P≤ .05

CC - Causal-Comparative
QE - Quasi-Experimental
PA - Protocol Analysis
RRMA - Review Research Meta Analysis
S - Survey
CR - Correlation Regression
FA - Factor Analysis

Table 2

FREQUENCIES AND RANGES OF SAMPLE SIZE AND NUMBER OF VARIABLES STUDIED FOR EACH RESEARCH DESIGN CATEGORY

Research Design	Sample Size Range	Sample Size $\bar{X}$	Sample Size Range	Sample Size $\bar{X}$
Quasi-Experimental	12-60	39.6	2-5	3.0
Review of Research/ Meta Analysis	N.A.+	N.A.	1-10++	2.7
Protocol Analysis	30-80	51.3	1-3	2.0
Survey	37-3510o	281.1	1-6	2.0
Case Study	3-456	66.5	1-5	2.2
Correlation/Regression	6-5649oo	132.1	1-11	2.7
Causal-Comparative	7-940	132.1	1-8	2.8
Factor Analysis/	54-946	227.3	1-5	1.7
TOTAL	3-5649	141.65	1-11	2.7

\+ Sample sizes were reported for 4 reviews only.
++ Variables studied were not reported in 12 reviews.
o Sample size not reported for 2 surveys.
oo Sample size not reported for 4 correlational studies.

Table 3

FREQUENCIES AND PERCENTAGES OF SAMPLE AGE LEVELS STUDIED AND YEAR OF PUBLICATION

Year of Publication	Pre-School/ Primary	Elementary	Secondary	K-12	College/ Adult	All Ages
1975	1	9	1	2	1	0
1976	3	15	4	8	0	1
1977	0	13	3	7	0	2
1978	3	28	2	12	2	0
1979	2	9	2	9	2	0
1980	2	25	2	9	2	1
1981	4	26	5	9	2	0
1982	2	34	9	11	1	2
1983	2	33	5	16	7	5
1984	9	37	6	7	2	2
1985	10	24	5	7	1	2
1986	4	17	12	14	6	1
TOTAL	42 (8%)	270* (52%)	57 (11%)	111 (21%)	26 (5%)	16 (3%)

* $p < .05$

Table 4

FREQUENCIES AND PERCENTAGES OF PUBLICATION TYPES BY YEAR OF PUBLICATION

Year of Publication	Journal	Government Report	Conference Paper	State/ District Report	College Publication	Dissertation
1975	7	--	--	--	--	5
1976	14	--	--	--	6	9
1977	12	--	1	--	1	9
1978	23	--	1	--	2	20
1979	9	--	1	1	4	9
1980	18	--	--	--	1	21
1981	24	--	--	1	--	25
1982	35	--	--	--	--	25
1983	39	--	1	--	1	26
1984	38	--	--	2	--	25
1985	20	--	--	--	--	26
1986	32	2	2	2	1	17
TOTAL	276	2	6	6	16	216
	(53%)	(.4%)	(1.2%)	(1.2%)	(3%)	(41%)

Table 5

FREQUENCIES AND PERCENTAGES OF PUBLICATION TYPES
BY DATABASE INCLUSION

Publication Type	Inclusion in ERIC	Inclusion in ECER	Inclusion in Psych. INFO
Journal	27	32	217*
Government Report	2	--	--
Conference Paper	6	--	--
State/District Report	6	--	--
College/Commerical Publication	5	11	--
Dissertation	--	--	216*
TOTAL	46	43	433
	(9%)	(8%)	(83%)